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DR. KENNETH WILLIAM NEATBY

The public service of Canada suffered a tragic loss on October 27 with the death of Dr. K. W. Neatby at the early age of 58. Dr. Neatby served Canadian agriculture with distinction as research cerealist (1926-1935), university professor (1935-1940), extension specialist (1940-1946), and research administrator (1946-1958). He had a strong interest in and a marked appreciation of current forestry problems and contributed greatly to the development of the Forest Biology Division during his twelve years as Director of Science Service.

CURRENT ACTIVITIES

ATLANTIC PROVINCES

Cable Car for Tree Sampling.—A cable car of the kind used by telephone linesmen was erected in a 70-foot stand of balsam fir to test this method of obtaining branches for spruce budworm sampling on permanent and semi-permanent plots. A large tree was chosen at the centre, and one at a point on the circumference of a 50-foot radius circle in which there were about 40 co-dominant trees suitable for sampling. A ⅝-inch flexible steel cable was attached with cable clamps to 1-inch diameter eye-bolts, inserted 55 feet above the ground through these anchor trees. Guys of galvanized telephone wire were strung to the bases of nearby trees in the stand, and tightened by twisting with a wooden bar. A wooden ladder and small platform were erected on the centre tree to permit easy entry to the car. The cable was tested immediately after construction with the weight of six men suspended near the ground from the centre of the span. Before proceeding out onto the cable at any time it was tested in this way with the weight of two men.

In using the device, the operator, tied securely to the car with a harness, advances along the cable to a position opposite the crown of a selected tree where he secures the car with the brake provided on one of the wheels. Pole pruners are used to remove the sample branches which are dropped to a canvas mat below or lowered in a basket attached to the car with a pulley. At most, 15 feet of pole was required and it was found that resting the bottom of the pole against the instep of one foot permitted the operator to exercise good control and considerable leverage over lengths at least 5 feet longer than this. Eight trees could be reached along the radius in which this span was erected. The span would be moved to obtain new trees and additional cables could be erected to provide more trees in the same circle.

Improvements in the seating arrangement on the car are desirable, consisting of lowering the seat to improve stability, and providing a contoured seat for greater security. The ⅝-inch cable could be safely replaced with ⅜-inch galvanized cable. The cable car costs $100 and the cable about $20; construction can be carried out by three men in two days. A skilled operator and two men on the ground could probably obtain samples from 40 to 50 mature trees per day; this is double the number of trees which can be sampled with the extension ladder presently used, and which requires four men on the ground. Since a number of other sampling devices are to be tested, and since decisions regarding the intensity of sampling on each tree at the low population levels which now occur will affect the ultimate technique to be used, this device has not yet been adopted.—D. G. Mott.

Egg Parasitism of the Fall Cankerworm.—Infestations of the fall cankerworm, *Alsophila pometaria* (Harr.), have occurred on a number of hardwood species in central and southern Nova Scotia for many years. In one area, near Wellington Station, Halifax County, the population was high from 1954 to 1956, inclusive, and almost all the foliage of red oak, red maple, and hawthorn was destroyed. In 1957, the cankerworm population was reduced to a low level and caused no more than a trace of defoliation in 1957 and 1958.

In 1956, fall cankerworm egg masses were collected immediately before hatching commenced in the field. Host larvae issued from more than 90 per cent of these eggs and no egg parasites were observed. In 1957, egg masses were collected in March prior to the normal period of exposure to parasite attack; about 97 per cent of these hatched in the insectary. A second egg collection in 1957 was taken on June 11 after eclosion had terminated in the field. Dissections of both hatched and unhatched egg masses showed that of 911 eggs, 90.2 per cent were parasitised, 8.2 per cent had produced larvae, 0.4 per cent contained fully-developed dead larvae and 1.2 per cent were infertile. A total of 8,106 parasites emerged from 12,638 eggs reared in cages under field conditions.

Two species of parasites, *Euplectrus mellipes* Prov. and *Telenomus alsophilae* Vier., were identified by the Insect Systematics and Biological Control Unit from a representative series of specimens. The relative abundance of each species is not known and it is possible that other parasite species may have been involved. This abnormally high parasitism associated with a sudden fall in population strongly suggests that the parasites were a major factor in terminating the outbreak.—M. M. Neilson and F. G. Cuming.

Status of the Spruce Budworm in the Lower St. Lawrence and Gaspe Peninsula at the End of 1958 with Special Reference to Spraying Operations.—The spruce budworm outbreak which had been active in the Lower St. Lawrence and Gaspe Peninsula since about 1950 came to an end in the summer of 1958. Each year, the outbreak had encroached upon new territories to the extent that, by 1956, nearly all balsam fir stands in an area of 14,000 square miles were affected.

Aerial spraying operations, first begun in 1954 in this region, were continued each year until 1958. The total operational acreage for the five years was 3,852,000 acres including respraying. In the past three years 16 per cent of the area treated was resprayed, leaving a net operational acreage of 3,225,000.

Until 1956, insect populations were maintaining themselves at high levels in unsprayed areas and were gradually reinvading those that had been sprayed. The first indication of a population decrease was apparent in the fall of 1956; in that year, the unusually cool summer prevented the spruce budworm from completing its life-cycle at elevations above 1,800 feet. In the Shickshock Mountains, the eggs were laid very late in the summer and many failed to hatch; the first-instar larvae apparently were also affected by the cold and failed to establish hibernacula (J. R. Blais—Effects of 1956 spring and summer temperatures on spruce budworm populations in the Gaspe Peninsula. Can. Ent. 90: 354-361, 1958). As a result, populations were drastically reduced the following year in a territory covering 1,600 square miles, or 12 per cent of the area under infestation.

In 1957, the summer months were unusually wet, especially July. The humid conditions were probably responsible for the widespread occurrence of disease that year in spruce budworm populations. Throughout the area, very large numbers of late instar larvae and pupae were affected by disease. A total of nine pathogens were recovered by W. A. Smirnoff, from dead material collected from the field in the area under discussion. Diseases caused by fungi were most prevalent; of the five species of fungi recovered, *Empusa grylli* and a *Sphaerosperma* sp. were most common. Bacteria, microsporidia, and virus also accounted for some mortality.

The combined influence of the cold summer of 1956 and the wet one of 1957 caused populations to be very low over 75 per cent of the outbreak area at the end of 1957. This is well shown by the egg counts made in 600 localities each year. In 1956, 61 per cent of the localities sampled gave a high egg population, that is a potential population capable of causing severe defoliation to the following year's foliage growth. In 1957, however, only 12 per cent of the localities sampled for eggs gave high populations.

Many areas where high egg-counts were obtained in the summer of 1957 showed relatively high larval populations in the spring of 1958. In Gaspe-Sud County, however, although a large proportion of the localities sampled for eggs showed high populations in 1957, the larval population the following spring was unexpectedly low. Some unknown factor or factors were responsible for killing the young larvae between the time of their emergence from the egg in August 1957 and their establishment in feeding sites in May 1958.

In the spring of 1958, all areas with moderate to high populations were treated with DDT, thus reducing to a low level what remained of the high populations. The residual populations in both sprayed and unsprayed areas were further reduced in the course of the summer through the action of natural control factors, predators and parasites being most important. Only indirect evidence could be gained of the role played by predators, while intensive and prolonged studies revealed more exactly the extent to which parasites were important. These studies carried out throughout the area showed that mortality caused by parasitism, although it varied somewhat between localities, was responsible for destroying an average of about 30 per cent of the spruce budworm population every year from 1954 to 1957. In 1958, however, mortality through parasitism was double that of past years. This was largely due to the action of *Meteorus trachynotus* (Vier.) and *Itoplectis conquisitor* Say which occurred in greatly increased proportions. Results of the egg-mass survey conducted in August 1958 revealed that in 91 per cent of the 600 localities sampled, no egg-masses were found, while in the remainder only light populations occurred. In 1959 populations of the spruce budworm in the Lower St. Lawrence and Gaspe are expected to approach the endemic level. A close check will be kept on the situation next year and for some years to come.

Tree mortality as a result of spruce budworm defoliation occurs in patches throughout most of the territory. In some cases only scattered trees are dead, while in others more or less solid blocks of dead trees are found varying from a few acres to several thousand acres. This represents but a small fraction of the trees that would now be dead had no spraying taken place. In the light of recent outbreaks elsewhere in Eastern Canada, the outbreak in the Lower St. Lawrence and Gaspe was of a magnitude sufficient to bring about the destruction of a high proportion of the mature balsam fir stands in the area. The fact that most of these stands survive indicates that the objectives of the spraying carried out over the past years have been substantially achieved. Furthermore, the spraying operations might have been an additional factor to those that contributed to the decline of the outbreak.

Since the recent outbreak did not appreciably alter the forest composition, in this area, extensive stands of susceptible forest remain, and, given favourable weather conditions it is possible that a new outbreak may develop. However, at least some years of respite can be counted upon, enough to permit a considerable recovery of vigour in the great majority of stands.—J. R. Blais and R. Martineau.

PRAIRIE PROVINCES

A Screening Test for Soil Sterilizers.—A large number of soil sterilizing chemicals can be utilized in forest nurseries for controlling fungi, insects, nematodes, and weeds. The ideal sterilizer should dissipate from the soil in a short time or be harmless to tree seeds and seedlings To explore these properties of the most promising chemicals a screening test was made with nine materials. The test was conducted at Saskatoon, Sask., in a rich loamy soil which was heavily and uniformly infested with seeds of various annual broad-leaved weeds. The chemicals were applied dry, or with water, on the surface of 1 x 1 ft. plots which were then immediately watered heavily. The chemicals were applied at different rates and at different intervals before seeding as shown in Table 1. Two hundred seeds of jack pine (*Pinus banksiana* Lamb.) were sown in each plot on July 10, 1958, and covered with sand. On July 12 there was a heavy rain (2.7 inches) which must have removed most of the water soluble chemicals from the surface. Because of the high temperature, the richness of the soil, and the rain, the conditions were favourable for rapid disappearance of the toxicity from the soil.

The plots were examined and results recorded (Table 1) three weeks after sowing. Where germination of pine seed was much less than in control plots this was attributed to chemical injury. Due to the nature of the experiment and to some insect and bird damage, the records cannot indicate low degrees of toxicity which may have occurred.

TABLE 1

Toxicity of Chemicals to Pine and Weeds in Nursery Seed Beds

Chemical and rates per sq. ft.	Interval before seeding (days)	Injury to pine (+)[1] and weediness (0-10)			
		Heaviest	Application rate		
			Heavy	Light	Lightest
Allyl alcohol	2	0	1	2	1
1, 2½, 5, 10 cc.	7	0	1	2	3
	14	1	3	3	8
Mylone 50[2]	2	+0	+1	1	3
0, 2½, 5, 10 gm.	7	+1	2	2	5
	14	+2	2	4	4
Vapam[3]	2	1	3	2	4
1, 2, 4, 8 cc.	7	3	3	5	4
	14	4	3	4	5
Hydrogen cyanamide (25%)	2	+1	+0	2	4
1, 5, 20, 50 cc.	7	+1	1	3	7
	14	+0	3	4	7
Formalin (37%)	2	+1	+5	6	9
1, 2, 2½, 5, 10 cc.	7	1	4	4	6
	14	7	10	8	6
Calcium cyanamide, granulated	2	+3	+3	+7	6
2, 3, 5, 8 gm.	7	4	6	7	5
	14	0	5	4	4

[1] Germination reduction more than 50 per cent.
[2] Tetrahydro-3, 5-dimethyl-2H-1, 3, 5-thiadiazine-2-thione (50% nondusting powder).
[3] 31% sodium N-methyl dithiocarbamate.

As shown in Table 1, allyl alcohol and Vapam did not injure pine even at the rates considered excessive. There was little relationship between the time of application and injury to pine. This may have been due to the heavy rain.

Weediness was evaluated by means of an arbitrary scale from 0 (no weeds) to 10 (plot heavily infested with luxuriously growing weeds). Degree 1 indicates one or two very small weeds per plot; 2 also indicates satisfactory control, but more weeds than in 1. As the table shows, five of the chemicals gave good or fair weed control with little or no injury to pine. Three chemicals, not shown in the table (Javex, 10% dichloro dimethyl hydantoin; Pano-drench, 0.6% cyano (methylmercuri) guanidine; and urea) failed to reduce weeds materially at concentrations noninjurious to the pine. If the 7-day waiting period is considered too long and very good weed control is required, the following four chemicals and rates per square foot are suggested by the results: (1) allyl alcohol at 1 to 10 cc.; (2) Mylone 50 at 2½ to 5 gm.; (3) Vapam at 2 to 8 cc.; (4) hydrogen cyanamide at 50 cc. Because there has been so little experience with the use of hydrogen cyanamide, a very wide range of concentrations was used; this chemical may perform well also at such intermediate rates as 3 and 10 cc. per sq. ft. Further studies are being made in field experiments with Mylone and hydrogen cyanamide. These two chemicals also act as fertilizers that may supply nitrogen to the plants.—O. Vaartaja.

The Importance of Adventitious Growth in Tamarack.—In 1956, a study was conducted in the Whiteshell Forest Reserve, Manitoba, to assess the foliage and shoot production of tamarack. It was necessary to establish a criterion of a branch, and for the purpose of convenience it was decided to sample only branches over 12 inches in length. In the course of sampling, it was noted that considerable foliage remained on some of the trees after the removal of the 24 sample branches and most of this foliage was on branches under 12 inches in length.

After several years of heavy larch sawfly attack or flooding, the upper crowns of tamarack may die, and the lower crowns may show mortality of some branches and the dying of the outer portions of others. Recovery of many of the trees is invariably through the production of adventitious shoots, especially along the main stem. On a vigorous tree these shoots may develop into branches of over 12 inches in length within two to three years.

In order to assess the amount of foliage rejected by the limitations of branch size, two trees were selected for study. It must be pointed out that these trees represented extreme cases of injury in their respective stands. Tree A was from a tamarack stand where the defoliation has been moderate to severe over the past eight years. Tree B was from a stand where periodic severe flooding has occurred, with defolia-

tion never exceeding light over the past ten years. The sample branches over 12 inches in length represented 38% and 62% of the total branches on trees A and B, respectively, whereas the analysis of smaller branches included all those under 12 inches in length. The foliage was removed from the branches and weighed. All current shoots were counted.

Table 1 shows the oven-dry foliage weight of estimated foliage for the trees from branches over 12 inches in length and the total oven-dry weight from adventitious growth under 12 inches. Also included are the number of shoots in each category. For tree A, 60% of the foliage and 75% of the shoots were contained on the smaller branches; for tree B corresponding figures were 24% and 33%, respectively.

The production of adventitious growth was very common in both stands and it is a factor that must be considered in sampling for foliage or shoot production. It is of interest to note that the tamarack stand from which tree A was selected is the only one in the area that has suffered a prolonged moderate to severe larch sawfly attack. All other tamarack stands in the area have supported only light populations since 1954. The extensive production of adventitious shoots is apparently a major factor in supporting high larch sawfly populations even after the trees have shown considerable branch mortality due to larch sawfly defoliation. Adventitious shoots undoubtedly are equally important in keeping trees alive following severe branch-killing as the result of flooding.—L. D. Nairn.

TABLE I

The Amount of Foliage and Number of Shoots from Tamarack by Branch Size

	Foliage Weight			Number of Shoots		
Tree	Branches over 12" (gm.)	Adventitious growth under 12" (gm.)	% Total foliage from adventitious growth	Branches over 12"	Adventitious growths under 12"	% Total shoots from adventitious growth
A	106.11	159.46	60%	146	438	75%
B	137.27	42.36	24%	263	127	33%

ROCKY MOUNTAIN REGION

Lodgepole Needle Miner, 1958.—Studies of the 1956-58 generation of *Recurvaria starki* Free. indicate that the present low populations in Yoho, Banff, Kootenay, and Jasper Parks are more or less static. There has been some increase in populations at lower elevations in Banff and Kootenay Parks and a slight decrease at the intermediate levels. This shift in population may be due to emigration of moths from the higher elevations.

Climate was found to be the major mortality factor. Parasitism, while accounting for up to 50 per cent of the surviving population, was about 20 per cent of the generation mortality. There has been a substantial reduction in actual parasite numbers. Disease was not present in either larval or adult needle miner populations.

Tree mortality, caused by past defoliation by the needle miner, has not increased significantly over the past five years—R. W. Stark.

BRITISH COLUMBIA

Control Operations Against Phantom Hemlock Looper, Nepytia phantasmaria Stkr. in British Columbia.—In 1956 the phantom hemlock looper population reached outbreak proportions in Central Park, Burnaby, and Queen's Park, New Westminster. Central Park was sprayed on August 3 by Skyway Air Service of Langley with a 10 per cent solution of DDT in No. 1 fuel oil at the rate of one imperial gallon per acre. The outbreak in Queen's Park was not discovered until it was too late to spray.

In 1957, when heavy looper populations were found, both parks were sprayed on June 24. Stearman aircraft were used. The insecticide was DDT dissolved in Standard Oil Base and applied at the rate of 1 pound of DDT in 1 imperial gallon per acre. Central Park was re-sprayed on August 8.

No spray deposit cards were placed in the parks so there were no data on spray recovery or droplet size. Because it was impossible to cut trees in the parks or to take branch samples owing to the large size of the trees, assessment work was restricted to beating samples from the understory trees. Beating samples were taken in both parks on June 20, June 22, August 1, and August 15. Canvas trays 2 by 2 feet square, were set under trees in both parks; after the trees were sprayed, all the larvae which dropped on the trays were preserved at 24-hour intervals for 10 days.

The phantom hemlock looper was the predominant insect, but other species such as black-headed budworm, *Acleris variana* (Fern.), spruce budworm, *Choristoneura fumiferana* (Clem.), and western hemlock looper, *Lambdina fiscellaria lugubrosa* Hlst., were present, although in such small numbers that by themselves they created no hazard to the trees. The largest number of phantom hemlock looper was found on western hemlock, *Tsuga heterophylla* (Raf.) Sarg. and Douglas fir, *Pseudotsuga taxifolia* (Poir.) Britt.

The average number of phantom hemlock looper per 1-tree beating sample prior to spraying, for all hosts, was 90.8 in Central Park and 34.0 in Queen's Park. Similar sampling 19 and 37 days after spraying showed an average reduction of 98.6 per cent in Central Park and 95.0 per cent in Queen's Park. The percentage decreases indicated by beating samples is probably not a true indication of larval mortality resulting from spraying as no corrections could be made for natural mortality. Only 1 larva out of 1,129 reared was parasitized, but a considerable number of larvae from both parks died of virus disease. Nevertheless, the figures do indicate a large reduction in population and it can be safely assumed that the spraying accounted for most of the decrease.

Of the larvae collected in the canvas trays the largest proportion, 40.1 per cent, dropped within 24 hours after spraying. Larvae were still dropping 10 days after the spray was applied.

Two days before spraying about 75 per cent of the phantom hemlock looper were in the third instar, 20 per cent in the second, and 3 per cent in the fourth.

About a week after Central Park was sprayed, park officials observed "large" numbers of larvae ascending the trees. Frass drop was also heavy, indicative of a fairly large population in the overstory trees. Fearful that the number of larvae was still large enough to cause heavy damage Central Park was sprayed again on August 8.

As a result of heavy defoliation in the northern portion of Queen's Park in 1956, 364 trees totalling 153,059 bd. ft. were killed. About 60 per cent of the volume was estimated to be western hemlock and 40 per cent Douglas fir. All the dead timber was salvaged in 1957. Some top-killing also occurred, and more trees may die.

Tree mortality was much lighter in Central Park, undoubtedly because of the spraying program in 1956. By April, 1958, 18 trees totalling 10,780 bd. ft. had died. On July 13, 1957, 25 trees were tallied and defoliation estimated. Ten of the 25 trees had lost from 70 to 95 per cent of their total foliage; all these trees were dead by April, 1958. The crowns of other trees which had been 50 to 60 per cent defoliated were extremely thin and some of these may die.—G. T. Silver.

Differences in Aspen Phenology and Survival of Immature Stages of Phyllocnistis populiella Chamb.—At Lavington, B.C., two adjacent groves of aspen trees, *Populus tremuloides*, were chosen for a study of possible effects of host phenology on populations of this aspen leaf miner. Trees in both groves were males of similar ages, and differed by about two weeks in time of leafing. Five trees in each grove were tagged and two branch samples were taken from each tree at intervals of about five days from the time that eggs were found to commencement of adult emergence. The populations of leaf miner from the two groves were compared at corresponding stages of development.

Adults of *Phyllocnistis populiella* began to oviposit on the early leafing trees when the buds opened and continued for a week until the leaves attained about two thirds their final size on May 4. On May 7 egg laying began on the late leafing trees, when the buds opened, and again ceased when the leaves attained two thirds their final size on May 13. This indicates that rate of leaf development may be a limiting factor for oviposition.

On the basis of egg larval counts, chi-square tests indicate at the one per cent level of probability, that more eggs were laid on the early leafing trees. The difference in numbers of eggs between upper and lower leaf surfaces of early leafing trees was not significant, although a higher concentration of eggs was laid on the upper leaf surfaces on the late leafing trees.

No difference appeared in larval parasitism between the groves, though parasitism was higher on the upper leaf surfaces of the late leafing trees. Total larval mortality was higher in the early leafing trees, which sustained a mean of only 0.74 cocoons per leaf compared with 1.29 cocoons per leaf on the late leafing trees. Amongst the early leafing trees, total larval mortality was considerably higher on the lower leaf surfaces.

Differences between groves and between leaf surfaces in respect to cocoon parasitism were not significant. Total cocoon mortality due to all factors, tended to be higher on the late leafing trees. Cocoon mortality was about the same on both leaf surfaces in each grove. Ultimately a higher net survival occurred on upper leaf surfaces amongst early leafing trees, while amongst the late leafing trees individuals on lower leaf surfaces seemed to be more successful (Tables 1 and 2). In absolute figures, slightly more adults were produced on the early leafing trees (0.23 per leaf) than on the late leafing trees (0.17 per leaf), though the per cent survival from egg to adult stage was about the same.

Apparently time of leafing of aspen trees may influence directly and indirectly intensity of oviposition, larval mortality, and survival of pupae of the aspen leaf miner. The results of the present study show that differences in tree phenology might be an important consideration when sampling for aspen leaf miner populations.—S. F. Condrashoff.

TABLE 1

DATA FROM EARLY LEAFING TREES

——	Number Examined	Upper Surface	Lower Surface	Total
Eggs and Larvae per leaf...	50 Leaves	2.32	2.98	4.98
Larvae Parasitized per leaf.	100 Leaves	0.14	0.15	0.29
Larvae Surviving to Cocoon stage per leaf............	200 Leaves	0.57	0.17	0.74
Cocoons Parasitized........ (per cent)	191 Cocoons	92 61.75	31 73.81	123 64.40
Total Cocoon Mortality.... (per cent).		99 75.00	33 78.57	132 69.11
Survival of pupae per leaf...	Cocoons per leaf X % surviving pupae	0.19	0.04	0.23
Net Survival from egg to adult (per cent)..........		8.19	1.34	4.62

TABLE 2

DATA FROM LATE LEAFING TREES

——	Number Examined	Upper Surface	Lower Surface	Total
Eggs and Larvae per leaf...	50 Leaves	2.16	1.30	3.46
Larvae Parasitized per leaf.	100 Leaves	0.14	0.03	0.17
Larvae Surviving to Cocoon stage per leaf............	150 Leaves	0.69	0.58	1.29
Cocoons Parasitized........ (per cent)	249 Cocoons	109 79.56	84 75.00	193 77.32
Total Cocoon Mortality.... (per cent)		125 91.24	91 81.25	216 86.75
Survival of pupae per leaf...	Cocoons per leaf X % surviving pupae	0.06	0.11	0.17
Net Survival from egg to adult (per cent)..........		2.78	8.46	4.91

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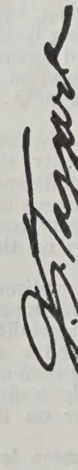

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